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AUTHOR Braun, Mark J.; Scully, Timothy L.
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ABSTRACT

This study was grounded in the geography school of diffusion theory, specifically focusing on Ormrod's concept of "spatial receptiveness." A survey was conducted to test how location of residence (urban vs. rural) is associated with consumer attitudes toward high-definition television (HDTV) and other expanded television services. Respondents (n=200) were questioned on prior exposure to information about the technology, sources of information, understanding of the technology, attitude toward it, price thresholds, factors that might influence adoption, and interest in expanding programming services that will accompany HDTV. Results indicated that location of residence was positively associated with the ability to accurately define HDTV, looking forward to adopting HDTV and expanding television services, the price one would be willing to pay, and whether there was a preference for HDTV and other expanded television services. The data also showed that knowledge of HDTV has not diffused to a majority of the population; fewer than one-third of the 200 respondents had even heard of HDTV. The majority of respondents who looked forward to HDTV were willing to spend more than $500 for a receiver; rural respondents were less willing to pay higher prices for the technology. Finally, those willing to pay more for HDTV also reported greater interest in expanded television services. Four tables illustrate the findings, and an appendix contains a copy of the survey instrument. (Contains 50 references.) (Author/MAS)

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ED 381 147

A PRE-DIFFUSION COMPARISON OF URBAN AND RURAL ATTITUDES TOWARD ADVANCED TELEVISION SERVICES

Mark J. Braun--Gustavus Adolphus College

800 West College Avenue--St. Peter, MN 56082

507-933-7368--mbraun@gac.edu

Timothy L. Scully--University of Saint Thomas

2115 Summit Avenue, LOR 303--St. Paul, MN 55105

612-962-5824--tlscully@stthomas.edu

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ABSTRACT

This study was grounded in the geography school of diffusion theory, specifically focusing on Ormrod's (1990) concept of "spatial receptiveness." A survey was conducted to test how location of residence (urban versus rural) is associated with consumer attitudes toward HDTV and other expanded television services. Respondents (n=200) were questioned on prior exposure to information about the technology, sources of information, understanding of the technology, attitude toward it, price thresholds, factors that might influence adoption, and interest in expanded programming services that will accompany HDTV technology.

Results indicated that location of residence was positively associated with the ability to accurately define HDTV, with looking forward to adopting HDTV and adopting expanded television services, with the price one would be willing to pay for HDTV, and with whether there was a preference for HDTV or for other expanded television services. The majority of respondents who looked forward to HDTV were willing to spend more than $500 for an HDTV receiver, but rural respondents were less willing to pay higher prices for the technology. Finally, those willing to pay more for HDTV also reported greater interest in expanded television services.

Running head: Urban/Rural Attitudes Toward Advanced Television

A PRE-DIFFUSION COMPARISON OF URBAN AND RURAL ATTITUDES TOWARD ADVANCED TELEVISION SERVICES[1]

High-Definition Television (HDTV) has been the subject of much interest and controversy for the past decade. While the Japanese system (MUSE) has been commercially available in that country and displayed at trade shows in the United States for several years, HDTV remains unobserved here by the general population and awaits the selection of a standard by the Federal Communications Commission before introduction into the marketplace. In contrast to the central coordination and funding of the Japanese effort, research in the U.S. has been conducted by private interests, alternating between cooperation and competition to develop a system that the Federal Communications Commission Advisory Committee on Advanced Television Service (ACTAS) will accept as the standard for HDTV broadcasting in the United States. After rejecting the MUSE system in favor of a digital standard, the ACATS encouraged the formation of a "Grand Alliance" of the remaining research interests in an effort to combine the best components of each into a superior system. FCC ACATS Chair Richard Wiley stated:

> I believe that the Grand Alliance, combining the best elements of the remaining systems, should produce a very advanced HDTV system. Moreover, because all of the proponents have endorsed the proposal, it also should minimize possible challenges to whatever determinations our Committee and the FCC ultimately make, and thus, expedite the introduction of advanced television in our country. (Wiley: May 24, 1993)

Still, the question remains "Why study HDTV?" HDTV is worthy of study because, despite the objection of some broadcasters, the transition to a new digital television system is inevitable given the enthusiasm of both government regulators and

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[1]An earlier draft of this paper was submitted to the Journal of Broadcasting and Electronic Media--The authors are grateful for the contributions of three anonymous reviewers whose comments are reflected in this revision.

consumer electronics industry leaders. Since 1987, the FCC has given tacit nods for the transition to a new television system, setting up an advisory committee, approving the establishment of an industry sponsored test facility, mandating a digital transmission system, and establishing a simulcast timetable for phasing in advanced television services and phasing out the old NTSC standard. With the migration to digital HDTV transmission, television will be integrated with other digital technologies such as personal computers and fiber optic networks featuring interactive programming and video on demand. Broadcasters in particular will have to make the transition at a considerable cost in new production and transmission equipment. Coming at a time of growing competition, reductions in advertising revenues and consequent profit declines, some broadcasters see few benefits from this substantial capital outlay. Nonetheless, the migration to digital must occur if over the air broadcasting is to survive in the digital age.[2]

Consumer interest is difficult to gauge because mass-mediated or interpersonal information about HDTV cannot adequately describe a technology that must be seen and heard to be appreciated. The average consumer, however, will most likely perceive HDTV as a replacement innovation, and until the standard is determined, there will be no HDTV receivers available to consumers in this country and consequently no advertising for such products. Such circumstances--the advent of a probable "replacement" technology that has not yet been directly experienced by a public which presently must rely solely on information gathered through secondary channels--make HDTV an ideal subject for a pre-diffusion study. In addition, there is concern that when the technology is introduced into the marketplace, considerably higher prices for HDTV receivers than for traditional TV sets may discourage many consumers from early adoption of the technology, especially when there is little evidence of consumer dissatisfaction with the present NTSC system. As recently as the August 1994, Eddie Fritz, President/CEO of the National Association of Broadcasters wrote to Senate Commerce, Science and

[2]In addition, certain industrial, medical, and military applications such as x-ray lithography and high-resolution and advanced imaging systems would benefit from the substantial increase in resolution and aspect ratio afforded by HDTV; see CBO, 1990.

Transportation Committee Chairman Ernest Hollings that HDTV is a technology "that no one else has any idea consumers will want to buy" (McConnell, 1994, p. 40). The lack of consumer-based research available to policy-makers may be due in part to the proprietary motives of the companies involved, nonetheless, Fritz's comment echoes yet another argument for the importance of studies on consumer attitudes towards HDTV on "applied" research grounds.

But this paper is not a report of strictly applied research. Theoretically grounded in the extensive diffusion literature, especially the geography school, this study contributes to a growing body of consumer-based pre-diffusion research by focusing on Ormrod's (1990) concept of "spatial receptiveness." It investigates how location of residence interacts with age and education as predictors of consumers' knowledge of and attitudes toward HDTV. It explores differences between rural and urban residents' exposure to information, and the accuracy of their understandings of information about the technology. Further, because of HDTV's expected integration with other technologies and services, the study examines levels of interest in expanded programming or interactive services and compares them them with interest in HDTV alone. The differences and similarities between the responses of the urban and rural samples provide predictive information concerning how diffusion of HDTV to consumers in these spatial environments may occur.

Theoretical Overview and Review of Literature

Ormrod (1990) recently detailed the differences between overall societal receptiveness and local context; building on the work of Torsten Hagerstrand, a physical determinist who viewed the diffusion of innovations as inextricably linked to spatial processes. Hagerstrand was the early leader of the "geography" school of diffusion study,[3] and his concept of "receptiveness" held that:

> it is probable that an uneven distribution of willingness and opportunity to accept innovations contributes to the situation where acceptance takes place more rapidly in certain areas than in others....bringing about a diffusion which is first characterized by agglomeration, and then by radical dissemination and simultaneous internal densifying [in a] very regular arrangement....characterized by a few centers, surrounded by concentric zones within which [adoption] ordinarily decreases with increasing distance (Hagerstrand, 1953/1967, p. 149)

Arguing that even in today's "well-connected" world the concept of local receptiveness is important, Ormrod noted that:

> Concern with adopter characteristics, however has been for the most part non-geographic in perspective and unorganized theoretically. Adopter evaluations of innovations and decisions to adopt or not adopt are seen primarily as a matter of individual economic circumstances or social status. Yet determinants of diffusion outcomes can be viewed as place-based (the perspective adopted here) as well as adopter-related....Acceptance decisions may be made by individuals, but those individuals are operating under constraints, most of which are products of their geographic setting. Residence in a particular area carries with it a certain set of environmental, cultural, social, and economic circumstances, circumstances that will be at least partially shared by all residents. These place conditions

[3]The geography school is, according to Rogers (1983, pp. 77-78), the smallest of the nine main diffusion research traditions. Rogers cites Lawrence Brown's observation that space/geography is "...probably one of the least-studied variables in the diffusion process" (1983 p. 268; see Brown, 1981).

> represent a context within which both the decision makers and the innovation must operate, a context therefore likely to affect that place's receptiveness to the innovation....receptiveness is shaped primarily by three context-based issues imbedded in adoption theory: (1) What is the local relevance of the innovation? (2) Are resources locally available to support adoption of the innovation? (3) What is the local viability of the innovation. (1990, pp. 111-112)

Therefore, while individual variables are important, they cannot be considered independent of the overall surroundings or spatial context. According to Ormrod, ability to support the cost of an innovation is an important place-based consideration, and survival of a new technology depends "not only upon the innovation...but also upon its ability to compete effectively with alternative practices that can satisfy the same needs and goals" (p. 112), in this case, the current NTSC television system. The present study will operationalize setting primarily as a function of an urban/rural dichotomy, and "receptiveness" will be operationalized as "looking forward" to owning the innovation. The urban/rural dichotomy is based on the work of Karlsson (1988), and others (Thompson 1965, 1968; McNeill, 1963; Malecki, 1981, Pred, 1966) who argued that inventions tend to generate in the large metropolitan areas of high technology regions.[4]

Successful innovations generally follow an "s-shaped cumulative curve" in that the diffusion advances slowly at first, but "takes off" after interpersonal networks become activated and evaluations of the innovation spread (Rogers, 1983, pp. 243-245). Naturally, it is impossible to predict the exact diffusion pattern that will be followed by HDTV, since the rate diffusion will depend on a number of variables. Nonetheless, the diffusion histories of previous consumer electronics technologies form a backdrop against which to predict the likely diffusion rate of HDTV and other forms of ATV. Farrell and Shapiro (1992) examined the diffusion histories of color television, cellular telephones, home video games, facsimile machines, and compact disk players in

[4]The present study was conducted in and around St. Paul/Minneapolis, Minnesota--corporate home to several high-tech firms, such as 3-M, Honeywell, and Control Data.

their economic analysis of HDTV standard setting.[5] Carey (1993) chose to utilize prices for telephone and telegraph service, radio sets, black and white television, color television and video cassette recorders (VCRs) in his price analysis. Carey included penetration data was presented for the above technologies, plus basic cable, answering machines, compact disk players, home computers, video game players, stereo TV, camcorders, projection TV, backyard satellite dishes [TVRO], cellular telephone, and home fax machines (p. 36).[6] Similarly, in attempting to predict the general pattern likely in the first stage of ATV diffusion (the innovation stage, defined as having a threshold of 1% penetration of households), Darby (1988, pp. 14-22) identified six consumer electronics innovations that share common characteristics with HDTV, and reported that these products diffused to 1% of U.S. households in the following number of years: both home PCs and "backyard" satellite TVROs, six to seven years; VCRs, seven to eight years; color TV, eight years; large screen/projection TV, 12-14 years; and stereo audio component systems, 20 years. Based upon these figures, and his analysis of the second stage (growth and imitation) of diffusion for these six innovations, Darby constructed two scenarios for ATV/HDTV diffusion. A "sluggish diffusion" scenario would result from spectrum and standard uncertainty, R&D/system/product delays, slow macroeconomic growth, substantial government deficit reduction, slow consumer spending patterns, high/rigid product prices and weak household preference for ATV products. Darby speculated that this "gloomy" scenario could:

> severely repress household penetration of these technologies and result in tepid sales performance over the next 20 years....Total sales in the $4 to $6.5 billion range might materialize, but the bulk of those would not be realized until after the turn of the century. These sales volumes are by no means trivial but, viewed in the context of 1986 sales of NTSC color receivers of over $6 billion, neither

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[5]Farrell and Shapiro also suggested why these cases *differed* from HDTV in key aspects, stating that "each of these technologies differs fro HDTV in so many ways that direct comparisons and or inferences about HDTV are extremely hazardous" (1992, p. 59).

[6]Two other sources of diffusion information for broadcast technologies are Sterling & Kittross, 1990, Appendix C, pp. 631-664; and Head, Sterling, & Schofield, 1994, pp. 44 (radio), 61 (television), 77 (cable), 98 (VCR), 100 (newer media).

are they impressive (p. 32)

Darby's second scenario, that of rapid product diffusion was predicated on timely and decisive FCC action in setting standards and allocating spectrum, accelerated R&D programs marked by diversity and price competition, sufficient sales to allow producers to exploit economies of scale and learning in the first ten years, and rapid development of moderately priced, high quality, compatible program supply programs. In this more optimistic scenario, Darby predicted that:

> the historic path of their NTSC predecessors may well provide a reasonable template for the future growth of similar ATV products. Scenario 2 is based on the following assumptions: one percent household penetration 7-8 years after introduction, 60% CAGR [compound annual growth rate] for the five years following, and steady, if unspectactular [sic], growth thereafter of 10% per year ....(p. 33)

Given these assumptions, Darby's ATV receiver growth scenario[7] (p. 34) indicated that HDTV would diffuse to 23.5 percent of U.S. households by 2002 (the end of year six) and to 93.9 percent by 2008 (year twelve).

Like nearly all "replacement" innovations in consumer electronics, HDTV will have a slow initial takeoff due in part to initial high prices and the increasingly rugged nature of existing apparatus in the hands of consumers.[8] Farrell & Shapiro, stated that:

> The lag between HDTV standard setting and HDTV set penetration is likely to be long. To some extent this is inevitable given the large and costly installed base of

[7]It should be noted that Darby constructed this scenario in 1988, and that the Grand Alliance digital HDTV system now in development will be introduced to the public considerably later than predicted in 1988. Thus the years reported by Darby are probably four to six years earlier than will actually be the case.

[8]Exceptions to this general rule were both broadcast radio and monochrome television, however since HDTV is a "replacement" technology, it is more realistic to expect a slower diffusion pattern, similar to that of color television.

> NTSC sets and the relatively long life of television receivers. If the HDTV lag is like the color [television] lag, few Americans will buy HDTV sets this millennium. Sets will be bought only after programming and distribution are in place. Households are the least likely to try to take a leadership role in establishing a new technology. 1992, p. 75

Carey asserted that, "in order for a new technology or service to achieve mass-market penetration, price has to come down sharply from the price levels at introduction." (1993, p. 33). Citing historical trends for radio, monochrome and color television and VCRs, Carey demonstrated how cost reductions enabled more consumers will have access to the innovations, promoting diffusion. Carey suggests that "in a 1990s context, a major electronic product--even if highly desirable--would probably have to drop to $500 or less in order to achieve a 50 percent penetration" (p. 34). Nonetheless, he also predicted that "...initial prices for high-definition television (HDTV) and similar services will be higher than an average household can afford to pay" (p. 38). Indeed, consumers will find HDTV sets expensive if market prices in Japan can be taken as a guideline. (Farrell & Shapiro, 1992, p. 5). Consumer reaction to HDTV in Japan has been somewhat disappointing (Crothers, 1991), perhaps because of the prevailing price range of $5000 to $8000, and Sony's 70% price reduction in 1992 was said to have been aimed at stimulating the lagging HDTV market in Japan (Sony Corp. will cut..., 1992). To overcome the barrier created by the necessarily high price of the innovation, Carey says "there will be a need for a first group of adopters (businesses and high-income households) who are able and willing to pay initial high prices" (1993, p. 38), as was the case with the VCR which initially appealed to "upscale high-technology aficionados" and only became popular with the masses with the advent of "lower prices and a different mix of uses, including videocassette movie rentals and (later) videocassette sales" (p. 35). Along these lines Farrell & Shapiro stated that the FCC should lean toward picking an HDTV system:

> that appeals to customers who will be marginal buyers of HDTV sets at the time

> when broadcasters and programmers are considering hopping on the HDTV bandwagon. Industry commentators believe that this time will probably be two to five years after the FCC chooses a standard. It would thus seem desirable not to cater to the 'vidiots,' those video-hungry consumers who will be the first to adopt HDTV, even when programming is in very short supply. Nor would it seem desirable to cater to the laggards in an attempt to accelerate or achieve universal HDTV service....This suggest to us that it would be wise to evaluate a system's cost after several years of production experience. (1992, p. 37)

Darby predicted a $3000 introductory price in the U.S., with a high and low price range of $800 and $400 once the price had dropped and stabilized, after about 10 years (1988, p. 37). Zenith Corporation has predicted that HDTV sets will cost "no more than" $500 more than today's color NTSC television sets (Farrell & Shapiro, 1992, p. 74[9]). Still, it is unclear what the public is willing to pay for HDTV. Indeed, we don't even know *if* the general public is willing to pay more for the improved digital picture and digital quality sound promised by the coming "Grand Alliance" system, and the interactive services that are likely to accompany it. One early report indicated that consumers would not readily adopt the innovation (Consumers cool..., 1988), while another study conducted for the Electronic Industries Association predicted that HDTV would be a success, and diffuse to 25 percent of U.S. homes by the year 2000 (Consumers will go..., 1988). Additional market testing is clearly necessary to reduce market and price uncertainty both in terms of HDTV and the expanded television services on the horizon. A recent news report concerning expanded services suggested that:

> What really matters, of course, is what people want to see on their TV sets and how much they are willing to pay. The preliminary results in this regard have not been encouraging.... [Cable firm] TCI reports that subscribers using its video-on-demand test trial in Colorado are ordering an average of 2.5 movies a month. That's probably fewer videos than many U.S. families rent each week. (Elmer-Dewitt, 1994, p. 46)

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[9]Citing *Electronic Business*, August 20, 1990, p. 39.

The FCC Advanced Television Advisory Committee was said to have developed an ambitious $1 million market research plan, but it was abandoned because of its cost. Results of the North American High Definition Television Demonstrations to the Public in 1988 and of an unpublished MIT survey indicated that while most people preferred HDTV, many said they would not spend more than a few hundred dollars extra for the service (Farrell & Shapiro, 1992, p. 74, note 104; citing Rice, 1990, p. 172).[10] A 1994 survey of 1000 cable TV subscribers conducted by Horowitz Associates Inc. and Cahners Research suggests that 19.5% of the respondents would be willing to pay $800 to $1000 for an HDTV set, and that 26.2% would be willing to pay extra for HDTV service (Jessell, 1994, pp. 76-77). In addition, 54% of the respondents were eager to try interactive TV services, although 24% of all subscribers said they would drop an existing cable service, such as basic or premium channels, to offset the cost (p. 76). Of course the population surveyed was at least wealthy enough or interested in television enough to pay for cable, and both of these factors might have skewed the results. The present study will extend this inquiry of price acceptability and the desire for interactive or other "expanded" services to a more general population, rather than to just cable subscribers.

There have been literally thousands of diffusion studies over the past fifty years. Early studies centered mainly on innovations in agriculture, medicine, education, and industry. Since the 1980s, studies have been conducted on the diffusion of most new communications technologies, including direct broadcast satellite (DBS), home videotape recorders, office automation, videotex and teletext, personal computers in home and work-settings, Compact Disc-Interactive (CD-I) technology, CD-ROMs and online databases, the diffusion of BITNET, electronic text services, and the diffusion of technology information programs.[11]

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[10]Rice is citing W. Russell Neuman's unpublished MIT paper "The Mass Audience Looks at HDTV: An Early Experiment."

[11]The seminal work of E.M Rogers (1962, 1971, 1983) is well documented, and is not reviewed in detail here. Stewart (1982) features an early review of literature on diffusion research, especially as it applied to computer technology. For specific studies on the mentioned

Generally, this line of research has suggested that younger people are more likely to adopt new technologies (Dozier, 1985), and that while the S-shaped curve is the norm in electronic technologies, a more "rapid" diffusion curve typically exists for new technologies (Rogers, Daley, & Wu, 1982, pp. 19, 63). Nonetheless, "the new communication technologies...are expensive. So only the socio-economic elite can afford them, and adopt them first (p. 22; see also Straubhaar,1987). In addition, while rural subjects tended to be less well off economically, to be older, less educated, and less likely to be exposed to new technologies through their schools or workplaces (several factors that would seem to discourage adoption) they nonetheless are as likely as their nonrural counterparts to use and view favorably new information technologies (LaRose and Mettler, 1989). This has been demonstrated in agribusiness by the growing use of computers and computer services on videotex and teletext among young farmers (Abbott, 1989). While at least one study found "an unusually high rate of female early adopters" of a public electronic networking system; other studies "...consistently find that females are more likely than males to maintain negative attitudes toward the importance of computing and their own abilities to use computers" (Collins-Jarvis, 1993, pp. 49, 51). Of course HDTV is fundamentally just a refinement of the existing NTSC television system. Because it is a digital technology however, it has the potential to easily tie in to new delivery systems (such as fibre optics and satellite distribution) and incorporate new technologies such as interactive services and computers. For these reasons it is more difficult to predict how such demographic variables as gender, education, location, or age will correlate with the diffusion of information about HDTV.

Since this article deals with the innovation-decision process in the early stages of HDTV information diffusion (and prior to the actual introduction of the innovation in the U.S. marketplace) it falls into the first of Rogers's eight types of diffusion research, "earliness of knowing about innovations" (1983, p. 79). Rogers formulated a number

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technologies, see Viggiano, 1994; Chamberlain & Hutchinson, 1993; Meihua, Zimpfer, Barnett, & Jacobson, 1993; Gurbaxani, 1990; Dozier, 1985; Dalton, 1989; Dennis, Soderstrom, Koncinski & Cavanaugh, 1990; Fine, 1986; Griffiths, Havelock, Sweet, and Cox, 1986; Collins-Jarvis, 1993; Gillespie and Robins, 1989; LaRose and Mettler, 1989; Abbott, 1989; Reese, 1988a; Reese, Shoemaker, & Danielson, 1986; Rice,1984; Bolton,1983.

of generalizations about "early knowers"--including that they have more education and are more cosmopolite than late knowers (1983, pp. 168-169). Rogers and Shoemaker (1971) reviewed over 100 studies and determined that the type of information channel can determine its effectiveness. Additionally, Rogers differentiated between mass media channels and interpersonal channels and concluded that mass media channels are "relatively more important at the knowledge stage and interpersonal channels are relatively more important at the persuasion stage in the innovation decision process" (pp. 198-201). This is innovation-dependent, however, as Rogers, Daley, & Wu (1982, p. 26) concluded that in the diffusion of home computers, interpersonal channels were more commonly reported as sources of information at the awareness-knowledge stage (54.6%) than were mass media channels (39.4%).

And yet, early knowing is only part of the total picture. Rogers observed that "Knowing about an innovation is often quite different from using the idea....Attitudes toward an innovation, therefore, frequently intervene between the knowledge and decision functions. In other words, the individual's attitudes or beliefs about the innovation have much to say about his [sic] passage through the innovation decision process" (1983, p. 169). For this reason, the present study goes beyond simply investigating early knowing, and explores the respondents' attitudes toward the innovation as well.

METHODOLOGY

The units of analysis in research of this type are individual members of the social system. The independent variables studied here are "respondent characteristics" such as place of residence, age, occupation, education, and gender. The dependent variables are knowledge of HDTV, source of information about the innovation, ability to accurately define the innovation, anticipation of HDTV, adoption intentions (such as early versus late adoption and market price expectations), and preferences for expanded services such as interactive television or video on demand.

The data were gathered in late April and early May of 1994 using telephone survey methods. The sampling frame was all residential listings in two telephone directories, described below. The sample (N=200) was stratified by geographical location, so that 100 respondents were selected from a frame of published telephone numbers in the Saint Paul Minnesota metropolitan area, while the other 100 respondents were selected from a frame of published telephone numbers in a wide area directory covering sixty one communities in the "Limestone Valley" area of south-central Minnesota. Systematic sampling with a random start was employed, so that the total approximate number of residential numbers in each directory was dividend by 100, with every *nth* number being called.[12]

The calls were made by two trained research assistants, working primarily between the hours of 7:00 and 9:00 p.m., Monday through Fridays.[13] The questionnaire was administered to the first adult answering the telephone, not necessarily to the person whose name was listed with the number. If a child answered the telephone, the person whose name was listed in the directory was requested. Independent variable (demographic) characteristics were coded nominally as follows:

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[12]For instance, in the "Limestone Valley" directory there were approximately 49,000 listings, so every 490th number was pre-selected for a total of 100 telephone numbers. A replacement strategy was utilized in the case of non-connecting calls or rejections, in which the number following the pre-selected number in the directory was called. This process was continued until a survey was completed and then the next "pre-selected" number was called.

[13]Thanks to research assistants Todd Whalen and Katy Halligan for conducting the interviews.

Place of residence was operationalized as "urban" (Minneapolis/Saint Paul) and "rural" (Limestone Valley);

Age was tabulated in four categories: (1) Under 25 year, (2) 25 to 44 years, (3) 45 to 64 years, and (4) over 64 years;

Occupation was recorded, but ultimately not categorized.[14]

Education was coded in four categories: (1) high school or less, (2) high school plus additional college or vocational education, but not a four year degree, (3) four year college degree, (4) four year college degree plus additional graduate or professional degree.

Respondents were asked if they had heard of HDTV, where they had heard about the innovation, and were asked to define HDTV. The respondents were asked if they looked forward to owning HDTV; and if they anticipated adopting early or waiting until later and if so, their reasons for waiting. Desired price thresholds were investigated among those who said they looked forward to the innovation. Dependent variable characteristics were coded nominally as follows:

Channel of information was coded as (1) interpersonal and (2) mass media; the latter was further sub-coded as (1) broadcast and (2) print channels.

Accuracy of subject's definition of HDTV was independently coded post hoc on a three point Likert-type scale; (1) incorrect, (2) partially correct, (3) correct) by the two principal researchers; intercoder reliability was calculated using Scott's pi (1955) and any disagreements were resolved by conference. The accuracy of the subject's definition of HDTV was judged based upon the inclusion of key concepts such as "improved picture

[14]The occupations were to be coded using a typology developed by Reese (1988b, p. 219), for a workplace based study on personal computer diffusion in which respondent's occupations were coded into four categories: professional, administrative/managerial, clerical/service, or blue collar. This typology proved to be unworkable in the present study given the number of retired persons, homemakers, and adult students in our sample--these could not be accounted for by Reese's typology. It was decided post hoc that employment was not a particularly important factor since this study concerns a home entertainment technology and does not deal with an innovation in the workplace, as did Reese's work on computers.

quality,""more lines/higher resolution," "digital," "improved-digital- or CD quality sound," etc. In addition, incorrect definitional components such as "3-D" or "already in stores locally" were considered to reduce the correctness of the definition. Intercoder reliability (π) was calculated at .84 using Scott's formula for pi (1955).[15]

Anticipation of the innovation was coded as "yes" or "no" according to the subjects self report as to whether or not they were "looking forward to" the innovation.

Reasons for waiting were coded as anticipation of waiting for (1) price to drop, (2) technology to improve, (3) current set to break, (4) opportunity to observe, and (5) other.

Desired price was operationalized as the price the subject reported as "willing to pay" for HDTV. Responses were categorized as (1) $500 or less, (2) $501 - $1000, (3) over $1000. In addition, the respondents were asked if they would be willing to pay a hypothetical introductory price of $4000.

Finally, the survey administrator read a description of some of the "expanded services" that are likely to accompany the advent of digital television. Respondents were asked if they would look forward to having these types of expanded services and what would be the relative importance of improved picture/sound versus expanded services.

Data analysis was conducted by examining frequency distributions and conducting a contingency table analysis utilizing the chi square (with continuity correction where necessary), Phi, and Cramer's V statistics. A copy of the final survey instrument is included as Appendix A.[16]

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[15] With a P_o of .905 and a P_e of .4056.

[16] An early version of the survey instrument was developed and pre-tested during November, 1993. Thanks to the following members of the HDTV research group, who worked with one of the authors as part of course SP 35, "Media and Society" at [institution name removed]: Steve Cota, Fredrick Idestrom, Greg Mazzuco, Reg Thomas, Vance Vinar and Eric Wolfram.

DATA

Descriptive Statistics This first section of data are the "pooled" rural and urban descriptive totals. Following this section is a report of the comparative statistics using chi square analysis to measure the rural and urban responses against each other. The gender distribution was nearly even, with 102 males (51.5)% and 96 females (48.5%). The age of the respondents was distributed as follows: those under 25 years, n=22 (11%); from 25 to 44 years, n=95, (47.5%); in the category of 45 to 64 years, n=49, (24.5%) and 65 years and up, n=34, (17%). The variable "location" was, due to the stratified sampling procedure, an even split; with 100 urban and 100 rural-area respondents. The variable "education" was distributed as follows: high school graduate or less than 12 years of schooling, n=62, (31%); high school plus additional vocational or college courses, but not a four year degree, n=52, (26%); four year college graduates, n=63, (31.5%); and finally, those with graduate school coursework or degree, n=23, (11.5%).

In terms of survey items relating to HDTV, 64 of the 200 respondents (32%) reported having heard of HDTV previous to our inquiry, the remaining 136 (68%) had not heard of the innovation. Of the 64 respondents who had knowledge of HDTV before our call, only 7 subjects (12%) reported having heard about the innovation through interpersonal channels, while 50 (88%) reported mass media channels. Of these media sources, 35 were "codable"--that is, responses were other than simply the phrase "media" or "mass media." There was a fairly even distribution among these 35, with 16 (46%) respondents reporting broadcast (television or radio) channels, while 19 (54%) reported print channels; most commonly newsmagazines or newspapers.

As noted in the methods section, the 64 respondents who had heard of HDTV prior to our survey were asked to define, as best they could, the innovation. The answers were independently coded post hoc on a three point Likert-type scale; (1) incorrect, (2) partially correct, (3) correct) by the two principal researchers. Intercoder reliability was calculated using Scott's pi (1955); in this study $\pi = .84$. The distribution for these definitions was as follows: 9 definitions (14%) were judged incorrect, 33 definitions (52%) were partially correct, and 22 definitions (34%) were judged to be

correct descriptions of HDTV.

As to whether or not the respondents were "looking forward to" HDTV (variable = anticipation), 134 of 197 respondents said "yes" (68%) while 63 (32%) said "no." Twenty eight respondents who reported not looking forward to the innovation could nonetheless anticipate eventual adoption; perhaps a feeling of the "inevitability" of new technologies was a factor. Among those who anticipated adopting at some future date (n=163 or 81.5%), almost none (n=3, 1.8%) anticipated adopting the innovation immediately upon its introduction. The overwhelming majority (n=160, 98.2%) expected to wait for some period of time before adopting the innovation. Typical reasons given for waiting to adopt HDTV by the 157 respondents (78.5%) who predicted their future behavior in this regard were waiting for the price to drop from its introductory level (n=114, 72.6%); waiting to evaluate the innovation--either personally or through the opinions of others such as informed friends or sources such as "consumer reports" (n=21, 13.4%); a desire to wait for technological improvements (n=11, 7.0%), and waiting for a currently used NTSC television set to break before replacing it with an HDTV set (n=8, 5.1%). In addition, three respondents (1.9%) gave other miscellaneous reasons.

Of these 163 respondents who anticipated future adoption of HDTV, only seven (4.3%) could envision paying $4000 for the innovation based on present knowledge of the product. The vast majority (n-156, 95.7%) said that they would not be willing to pay such a large amount. Of 161 respondents who offered a price they would be "willing to pay" for HDTV, 90 subjects (56%) were willing to pay over $500; that is, 52 subjects (32.3%) named a dollar amount that fell into the category of "$501 to $1000," while 38 of the respondents (23.6%) volunteered a dollar amount greater than $1000, but less than the $4000 suggested introductory price. A total of 71 subjects (44.1%) reported an amount that fell into the category of "$500 or less;"

Finally, the anticipation of expanded services was quite high among those surveyed. Of the 199 responses to this item, 126 subjects (63.3%) said they would look forward to expanded services such as "video books and newspapers, home banking and shopping, movies on demand, interactive games or educational services, and

television linked to a personal computer or telephone." 73 of the respondents (36.7%) said they did not look forward to having such services in their home. Nonetheless, to a majority of the 158 respondents who expressed an opinion, the prospect of expanded television services was even more attractive than the potential for improved picture and sound. When asked to rank the relative importance these two sets of features, 95 of those responding (60.1%) felt that the promise of expanded services was a more attractive feature. Improvements in picture and sound was ranked more highly by just 57 people (36.1%). In addition, six respondents (3.8%) said that both features were equally attractive.

Comparative Statistics

The following section reports results of the chi square analysis comparing the variable "location" with the demographic variables age, education, and gender; and the technology variables investigated in the survey. Contingency table analysis demonstrated that location was a powerful predictor of several variables. As table 1 indicates, location varied significantly with the age, education, and gender demographics.

Table 1
Comparative statistics: demographic variables and location.

		Rural	Urban
Age	Under 25 years	10%	12%
	25 to 44 years	37%	58%
	45 to 64 years	27%	22%
	65 years plus	26%	8%
Education	High School	41%	21%
	High School Plus	29%	23%
	Four Year College	22%	41%
	College Plus	8%	15%
Gender	Male	64%	39%
	Female	36%	61%

Age, total chi-square =14.864 (3, N= 200) p = .0019, Cramer's V = .273;
Education, total chi-square =15.005 (3, N= 200) p = .0018, Cramer's V = .274;
Gender, total chi-square = 12.67--with continuity correction = 11.678 (1, N=198) p = .0004, with continuity correction = .0006, Phi = .253.

In addition, location corresponded significantly with a number of "technology" attitude variables, as indicated in Table 2.

Table 2

Comparative statistics: technology variables and location.

		Rural	Urban
Accuracy	Incorrect	18%	11%
	Partially correct	64%	42%
	Correct	18%	47%
Anticipation	Look forward to HDTV	59%	77%
	Don't look forward to HDTV	41%	23%
Exp. Services	Look forward to E.S.	53%	74%
	Don't look forward to E.S.	47%	26%

Accuracy of definition, total chi-square = 6.023 (2, N= 64) p = .0492, Cramer's V = .307;
Anticipation, total chi-square = 7--with continuity correction = 6.215 (1, N= 197) p = .0081, with continuity correction = .0127, Phi = .189;
Interest in expanded services, total chi-square = 9.878--with continuity correction = 8.975 (1, N= 199) p = .0017, with continuity correction = .0027, Phi = .223.

Among just those respondents who reported looking forward to HDTV, there still were significant differences between location and price desired, and between location and preference for improved picture versus expanded television services. The percentiles for these variables are shown in Table 3.

Table 3

Comparative statistics among those who said they looked forward to HDTV.

		Rural	Urban
Desired Price	$500 or less	56%	22%
	$501 to $1000	25%	41%
	Over $1000	18%	36%
Preference	Improved Picture (HDTV)	31%	36%
	Expanded Services	58%	64%
	Both	11%	0%
Price: Total chi-square = 16.079, df=2, N= 131, p = .0003, Cramer's V = .35; Preference: Total chi-square = 8.955, df=2, N= 128, p = .0114, Cramer's V = .265.			

Finally, among just those persons expressing an interested in expanded television, there was still a significant relationship between location and preference for improved picture versus expanded television services. The percentages for these variables is found in Table 4.

Table 4

Comparative statistics among those who looked forward to expanded television services.

		Rural	Urban
Preference	Improved Picture (HDTV)	27%	22%
	Expanded Services	62%	78%
	Both	11%	0%
Total chi-square = 9.907, df=2, N= 125, p = .0071, Cramer's V = .282			

DISCUSSION AND CONCLUSIONS

A summary of the more significant findings and their implications are reported here, especially as they relate to the concept of spatial receptiveness. In general, as education increased, so did the likelihood that a respondent had heard of the innovation. From the standpoint of spatial receptivity, it is important to note that the level of education was significantly greater for the urban sample. In fact, the percentages of persons with four year college and graduate school degrees were nearly twice as high among urban respondents (41% and 15% respectively) as for the rural sample (22% and 8%).

In addition, early knowers were most often in the 45-64 and 25-44 year age groups. This finding conflicts with previous literature on new technology diffusion (Dozier, 1985) and deserves to be investigated further. It may also be tied to spatial receptiveness; although the percentage of respondents under age 25 was about equal for the two locations (r=10% , u=12%), the percentage of those age 65 and older in the rural sample (26%) was triple that of the urban sample (8%).

A confounding artifact that also needs to be investigated further was the fact that the rural sample was skewed slightly to male respondents (m=64%) as opposed to the urban sample, in which females were more heavily represented (m=39%). Stratified sampling by gender would allow for this difference to be eliminated. This would be especially important, since gender differences were were found to vary significantly with prior knowledge of the innovation. Three-quarters of the respondents with prior knowledge of HDTV were men. However, men seemed no more likely to give accurate definitions of the technology than women. These findings deserve further investigation.

Overall, the percentage of respondents who correctly defined HDTV was much greater for the urban sample (r=18%, u=47%), as was the ratio of those who looked forward to the innovation (r=59%, u=77%). In regard to price, over half of the respondents who looked forward to adoption of HDTV were willing to spend more for the innovation than the under-$500 price commonly charged for color NTSC receivers

today. About one-third were willing to pay between $500 and $1000 for HDTV and just under one-quarter were willing to pay over $1000. This finding indicates that there is a willingness to spend more for this innovation than was anticipated by Carey (1990). The correlation between price and location showed that the rural sample was much less willing to pay higher prices for the technology. Even among just those who looked forward to HDTV, the percentages of those who wanted to pay just $500 or less for the receiver was much greater for the rural sample (r=56%, u=22%) while those willing to pay between $500 and $1000 (r=25%, u=41%) and over $1000 (r=18%,u=36%) were more likely to be urbanites. Although this finding could be an artifact of lower rural incomes, income information was not gathered for this study because it was feared that respondents would be unwilling to accurately report income. Such information would have been useful in explaining price differences between the rural and urban samples and future surveys should attempt to collect income information.

The results of this study also demonstrate that those willing to pay higher prices for HDTV sets also had a greater interest in expanded services; although among those respondents with prior knowledge of HDTV there appeared to be no predictive association between such knowledge and the desire for expanded services. If there is a greater desire for such services over the enhanced reception of HDTV, it may be related to the more tangible nature of interactive services, movies on demand, home shopping, etc., in contrast to the less tangible nature of enhanced reception. As mentioned in the introduction, it is not clear if consumers feel the need for HDTV. Even those who have seen televised reports on the technology have not actually seen and heard it. Experiencing the benefits of HDTV is only possible during a "live" demonstration. This may also be why many of those who have heard about the technology cannot accurately describe it, nor do they eagerly anticipate its adoption. A laboratory study that includes such a demonstration may be a much better gauge of consumer interest than a telephone survey.[17]

While most of the respondents would wait for the price to drop before adopting

[17]At the time of this writing, non-expert viewing tests were being conducted for the FCC Advisory Committee for Advanced Television Service by the Advanced Television Evaluation Laboratory of Ottawa, Canada.

the technology, others would wait for public opinion to guide them or for their sets to wear out. Some would wait for the technology to improve. Interestingly, no one mentioned waiting for increased availability of programming, even though this variable seemed closely tied to the adoption of color television in the 1950s and '60s.[18]

Finally, it is interesting to note that some variables did not vary significantly with rural versus urban location. The factors that did not produce significant levels included previous knowledge of the innovation (reporting having "heard of" it), looking forward to adoption of the innovation, reasons anticipated for waiting to adopt, and willingness to pay a high introductory price estimated at around $4000. Again, these four areas did not vary significantly with "location." It is likely that knowledge of HDTV did not vary because, as the data indicated, mass media channels were the most common source of information, and these channels would be fairly evenly distributed across both rural and urban locations. What remains to be investigated is why the urban sample was almost three times as likely to be able to correctly define the innovation. We would speculate that this is tied to level of education, which of course is related to geographical demographics.

As for the other three factors not associated with geography (looking forward to HDTV, reasons anticipated late adoption plans, and unwillingness to pay $4000), these are "market" factors that also do not vary much with geography. The fact is, most consumers, whether rural or urban, have become accustomed to waiting for prices for new technologies to drop dramatically. They have also shown a propensity to wait to buy replacement technologies until their original equipment breaks or becomes outmoded. It is likely that, even in the absence of detailed information, consumers feel resigned to the prospect of NTSC television being replaced by something new, just as audio cassettes

[18]The importance of programming availability can be illustrated by the case of color TV diffusion. In 1955, .02% of American television set were color, while by 1965, the number increased to 5.3%. That figure jumped to 24.2% in 1968. (Sterling & Kittross, 1990, pp. 657-658). Consider too that in 1955 only about 200 annual hours on network programming were broadcast in color, compared to close to 6,000 annual hours in 1965 (Farrell & Shapiro, 1992, p. 54).

and digital audio compact discs have largely replaced vinyl records, and VHS videotape home"movies" have replaced Super 8. This might account for why both rural and urban respondents anticipated eventual adoption, although the urban sample clearly was willing to pay more. Future research should investigate these variables in more detail as well.

In conclusion, the findings of this study support previous research on "spatial receptiveness" by indicating that location of residence -- and/or variables that often are correlative with geography, such as education and age -- can be significant predictors of prior knowledge and anticipated behavior. The data also show that knowledge of HDTV has not diffused to a majority of the population. Fewer than one third of the 200 respondents (r=28, u=36) had even heard of HDTV. As exposure increases through the media and as people begin to encounter the technology first-hand, continuing study of changing attitudes and perceptions will give researchers and marketers further insight into the diffusion process. Eventually, "observability" and "trialability" in the form of live demonstrations might generate greater knowledge of and increase levels of enthusiasm for HDTV. Still, this study paves the way for greater understanding of how location will play a role in the diffusion of new television services in the U.S.

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APPENDIX A

Copy of Survey Instrument

HDTV Diffusion Survey Survey Number_____

1. **Demographics**
   - a- Which category best describes your **age**? (Circle) **A** under 25 **B** 25-44 **C** 45-64 **D** 65 - up
   - b- What is your **occupation**?_____
   - c- What is your **educational** background? _____
   - d- **Gender** (no need to ask if obvious) (Circle) Male Female
2. **Definition**
   - a-Have you ever **heard of** high definition television or "HDTV"? (Circle) **Yes** **No** (if no, skip to 3).
   - b-**Where** did you hear about HDTV?_____
   - c- How would you **define** or describe HDTV? (note)

     _____

     _____

   Accuracy--circle number: (incorrect) 1 2 3 (correct)
3. **HDTV** (read correct definition) "High definition television or "HDTV" is the new digital TV system that will be introduced in the US in the next few years. HDTV will offer more than twice the picture clarity of today's conventional television, have a wider screen, and feature CD-quality sound."
   - a- Would you **look forward** to owning this new type of television set? (Circle) **Yes** **No**
   - b- Would you purchase HDTV when sets are first introduced, or wait until later? (Circle) **E** **L**

     If "E" go to 3d, If "L" ask:
   - c- What would you wait for?_____
   - d- (read) "The cost of an HDTV set could initially be over $4000. Would you be willing to purchase an HDTV set at the predicted introductory price? (Circle) **Yes** **No**

     If "Yes", Go to 4. If "No"- ask :
   - e- It's likely the price would drop after the first few years. At what price would you consider buying an HDTV set? $_____
4. **Expanded services**(read) "High definition television could even be part of an expanded television service that might include video books and newspapers, home banking and shopping, movies on demand, interactive games or educational services, and television linked to a personal computer or telephone."
   - a- Would you look forward to having these types of expanded services? (Circle) **Yes** **No**
   - b- What features would be more attractive--(circle) **A** improved picture, or **B** expanded services

THANK YOU FOR YOUR PARTICIPATION